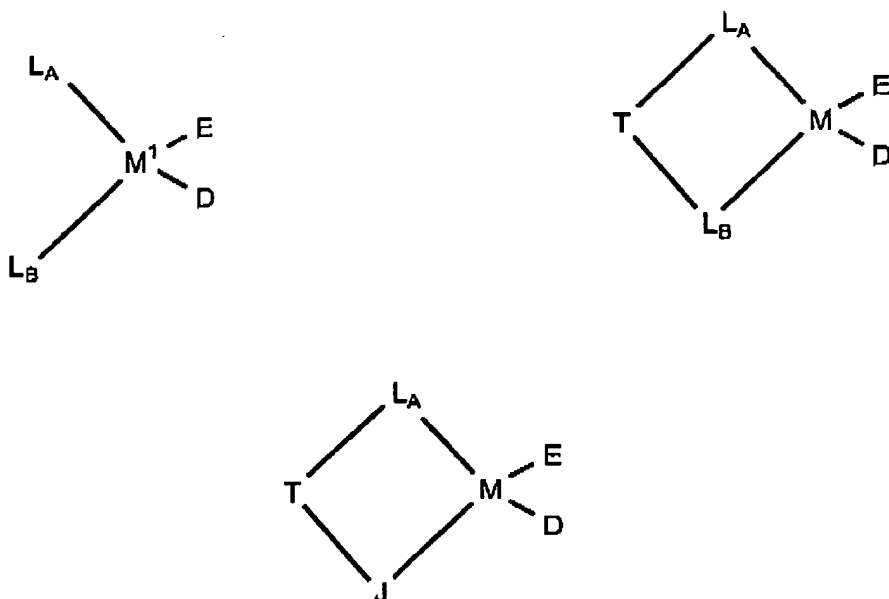


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Listing of the Claims:

This listing of claims will replace all prior versions and listings of claims in the application:

1. (currently amended) A composition comprising the product of combining, in the presence of a free radical initiator, a catalyst precursor and at least one monomer wherein the monomer is polymerizable by free-radical polymerization, and wherein the catalyst precursor is represented by one of the formulas:



wherein

- (a) M is titanium a ~~Group 3-10 metal~~;
 M' is titanium a ~~Group 3-10 metal~~;
- (b) L_A is a substituted or unsubstituted, cyclopentadienyl or heterocyclopentadienyl ligand connected to M wherein L_A comprises R ;

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- (c) L_B is
- (i) a ligand as defined for L_A but selected independently of L_A , or
 - (ii) ~~J, a heteroatom ligand connected to M, wherein J comprises a Group 14-15 atom and 0-2 of R";~~
- (d) T is a bridging group that connects L_A and L_B and comprises a Group-13-to-16 element and 0-2 of R'; and
- (e) D and E are the same or different abstractable ligands,

wherein each R, R', and R" are independently ~~selected from~~ hydrogen or a hydrocarbyl group provided at least one of R, R', and R" can be polymerized by a free radical initiator. ~~provided that when M^+ is Zr, L_A is substituted at more than one carbon atom.~~

2. (currently amended) The composition of Claim 1 wherein each R, R', and R" are independently ~~selected from~~ hydrogen or a C_1 - C_{50} hydrocarbyl group.
3. (currently amended) The composition of Claim 1 wherein each R, R', and R" are independently ~~selected from~~ hydrogen or a C_1 - C_{20} hydrocarbyl group.
4. (currently amended) The composition of Claim 3 wherein each R is independently one of hydrogen, allyl, methyl, or a phenyl group ~~phenyl groups~~.
5. (canceled)
6. (canceled)
7. (currently amended) The composition of Claim 3 wherein the abstractable ligands are independently hydride radicals; hydrocarbyl radicals; or hydrocarbyl-substituted[,] organometalloid radicals.

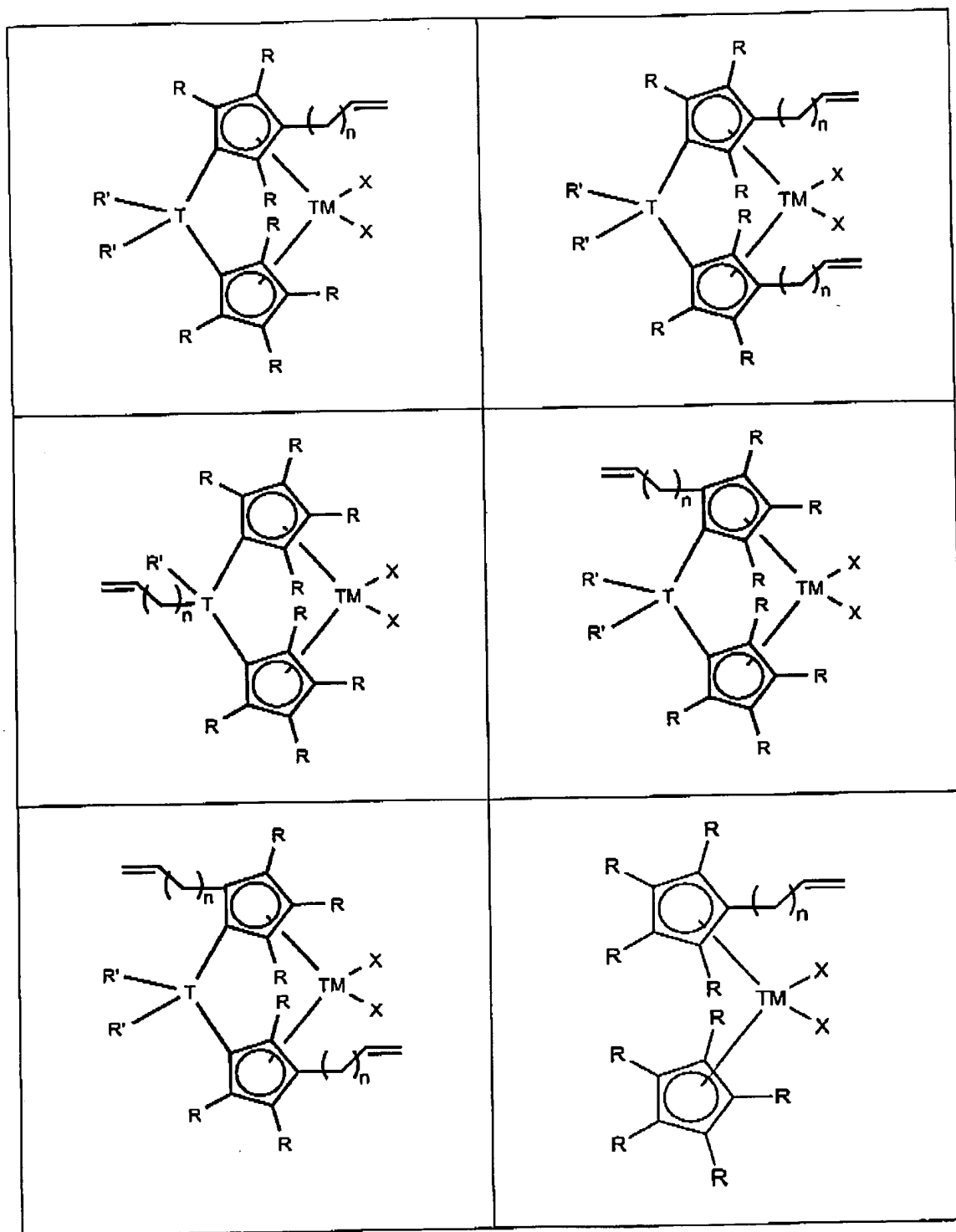
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8. (currently amended) The composition of Claim 7 wherein two of the abstractable ligands join to form a 3-to-40-atom metallacycle ring.
9. (currently amended) The composition of Claim 3 wherein the abstractable ligands are independently halogen, alkoxide, aryloxy, amide, or phosphide radicals.
10. (currently amended) The composition of Claim 3 wherein the abstractable ligands are chloride, bromide, iodide, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, methoxy, ethoxy, propoxy, butoxy, dimethylamino, diethylamino, methylethylamino, phenoxy, benzoxy, allyl, 1,1-dimethyl allyl, 2-carboxymethyl allyl, acetylacetonate, 1,1,1,5,5,5-hexafluoroacetylacetonate, 1,1,1-trifluoro-acetylacetonate, or 1,1,1-trifluoro-5,5-dimethylacetylacetonate radicals.
11. (currently amended) The composition of Claim 3 wherein at least one of the abstractable ligand is chloride.
12. (original) The composition of Claim 1 wherein the at least one monomer comprises styrene, vinyl styrene, alkyl styrene, isobutylene, isoprene, or butadiene.
13. (original) The composition of Claim 12 wherein the one or more monomers comprise styrene.
14. (currently amended) The composition of Claim 1 wherein the free radical initiator is selected from the group consisting of azo initiators or peroxides.

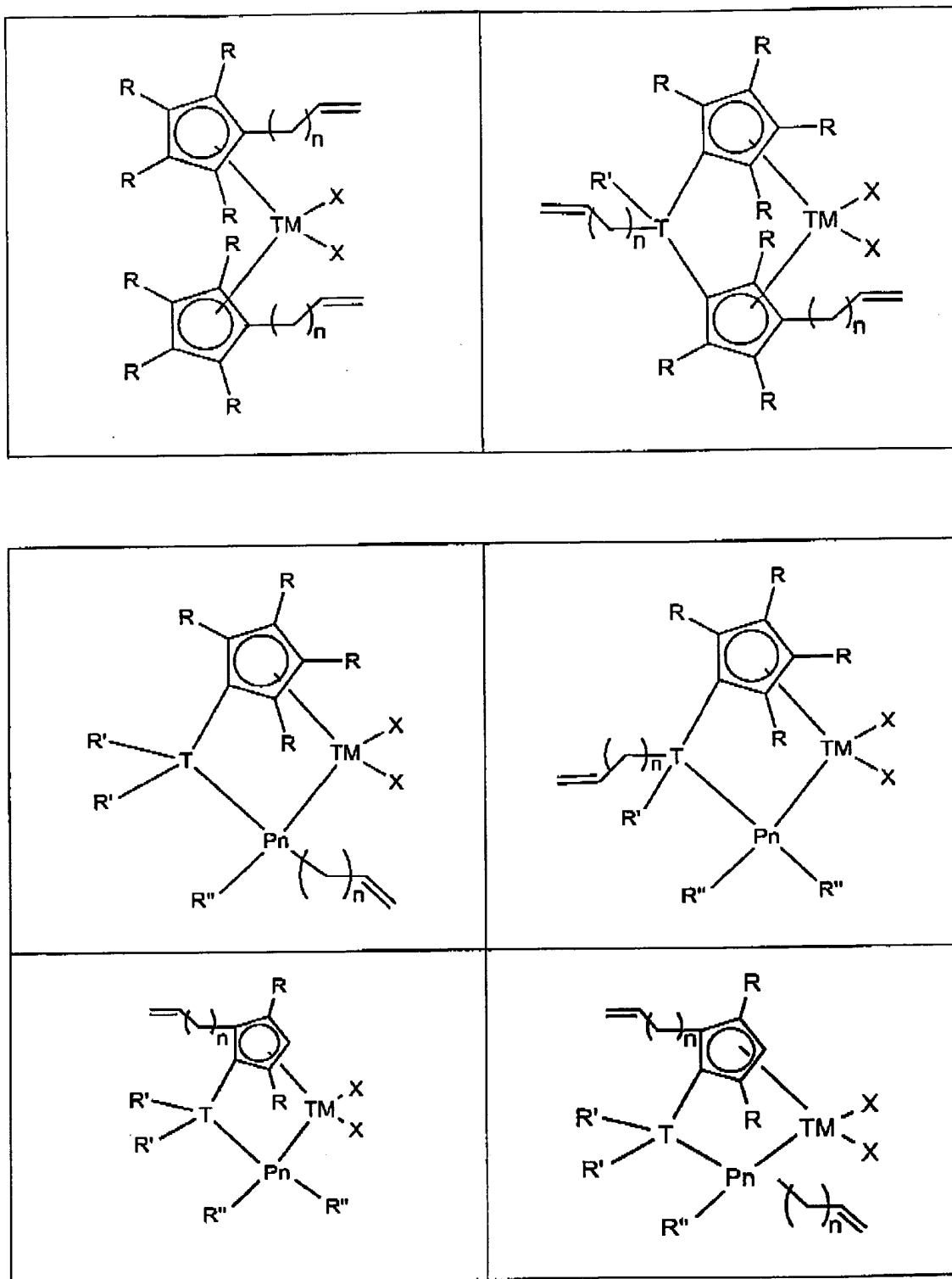
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15. (currently amended) The composition of Claim 3 wherein the free radical initiator is selected from the group consisting of dialkyldiazenes, hyponitrites, diacyl peroxides, dialkyl peroxydicarbonates, peresters, alkyl hydroperoxides, dialkyl peroxides, or inorganic peroxides.
16. (currently amended) The composition of Claim 15 wherein the free radical initiator is selected from the group consisting of 2,2'-azobis(2-methylpropanenitrile), 1,1-azobis(1-cyclohexanenitrile), 4,4'-azobis(4-cyanovaleric acid), triphenylmethylazobenzene, di-t-butyl hyponitrite, dicumyl hyponitrite, dibenzoyl peroxide, didodecanoyl peroxide, diacetyl peroxide, diisopropyl ester, dicyclohexyl ester, cumyl hydroperoxide, t-butyl hydroperoxide, dicumyl peroxide, di-t-butyl peroxide, hydrogen peroxide, and persulfate initiators.
17. (withdrawn) A catalyst system comprising the reaction product of the composition of Claim 1 and an activator.
18. (withdrawn) The catalyst system of Claim 17 wherein the activator is selected from alumoxanes, aluminum alkyls, alkyl aluminum halides, alkylaluminum alkoxides, discrete ionic activators, and Lewis acid activators.
19. (withdrawn) The catalyst system of Claim 18 wherein the activator is selected from methylalumoxane, modified methylalumoxane, ethylalumoxane, trimethyl aluminum, triethyl aluminum, triisopropyl aluminum, diethyl aluminum chloride, alkylaluminum alkoxides, ammonium borate salts, phosphonium borate salts, triphenyl carbenium borate salts, ammonium aluminate salts, phosphonium aluminate salts, triphenyl carbenium aluminate salts, trisarylborane acids, and polyhalogenated heteroborane anions.
20. (currently amended) The composition of Claim 1 wherein the catalyst precursor is represented by one of the following formulas:

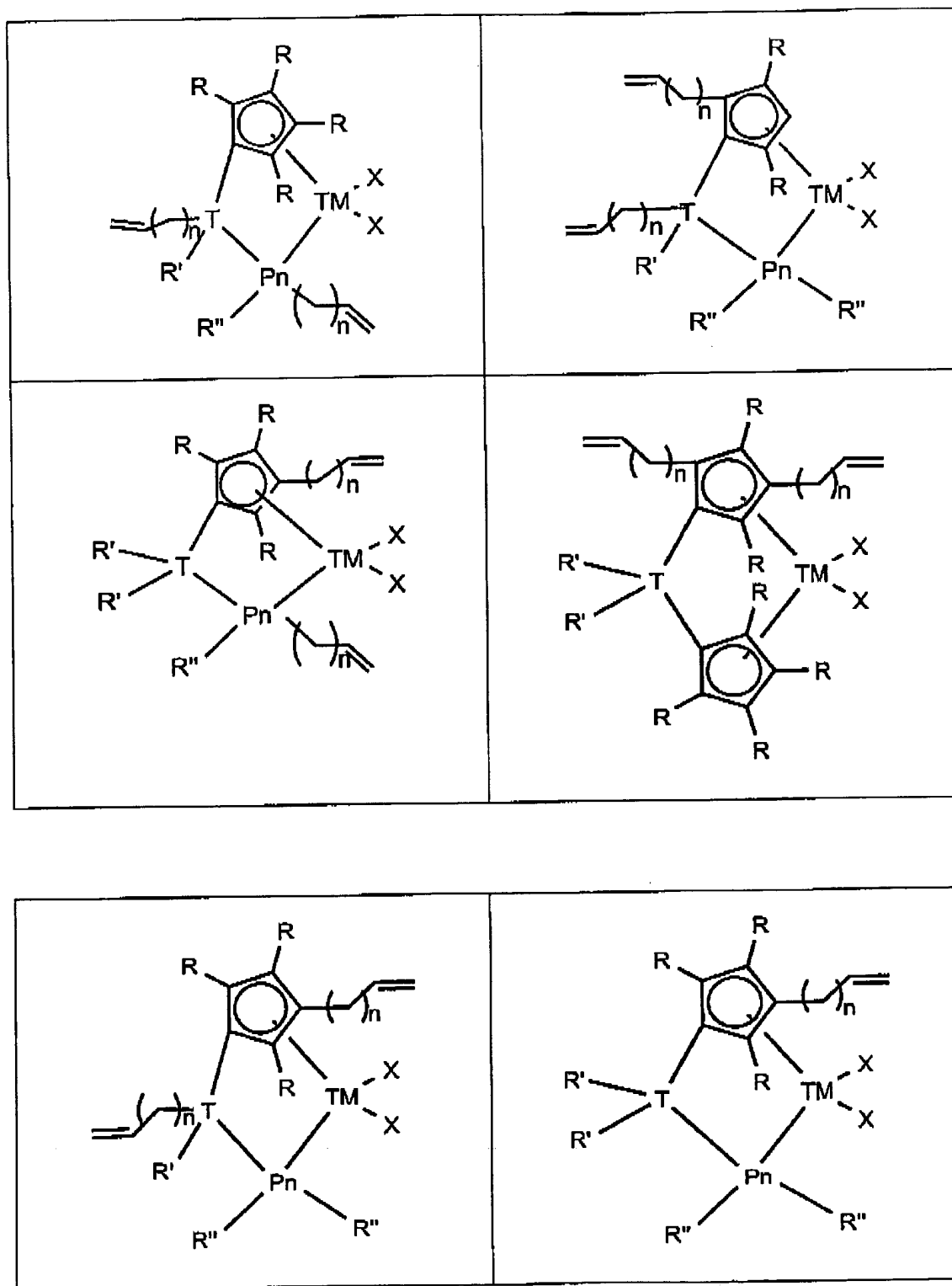
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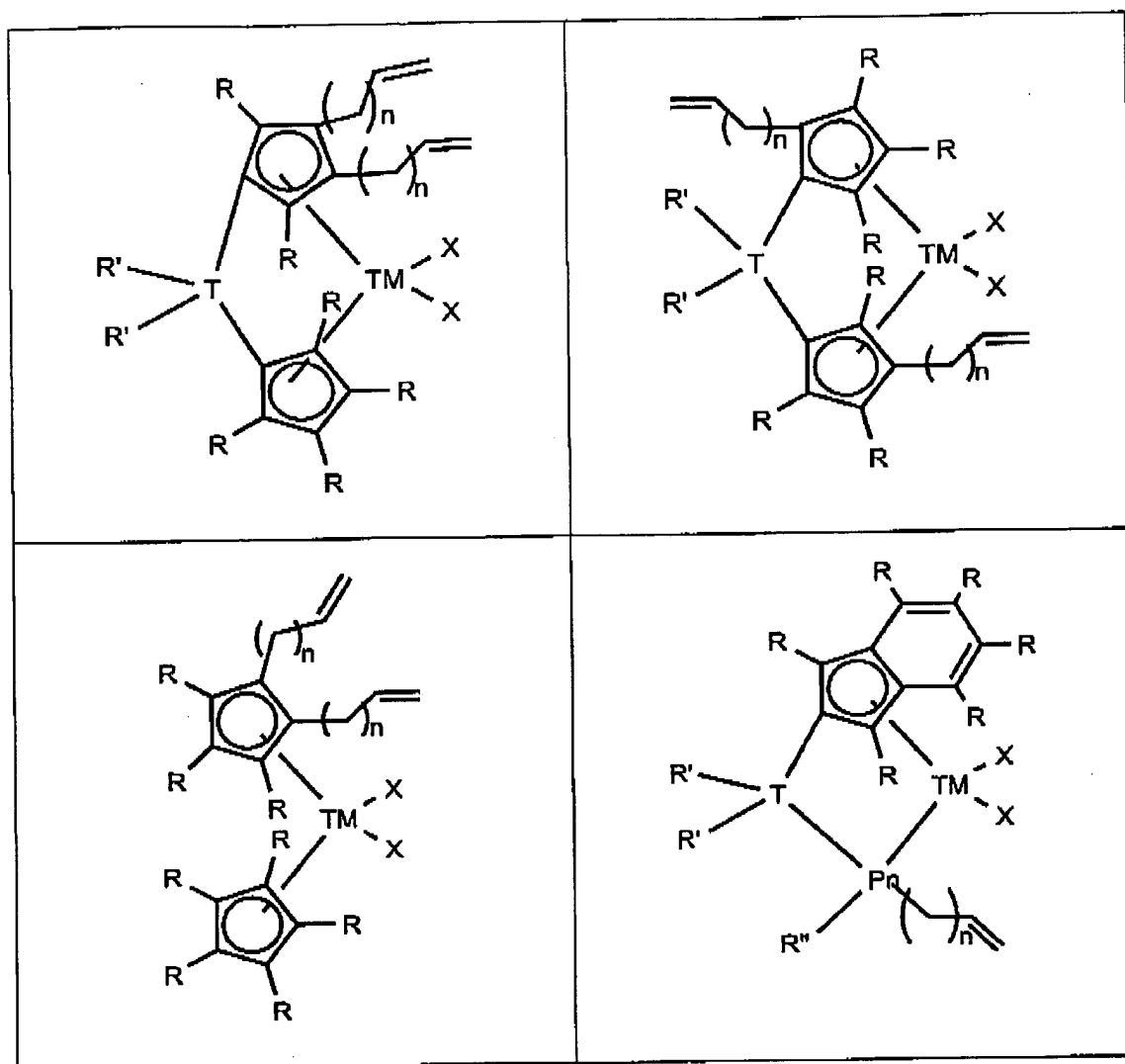
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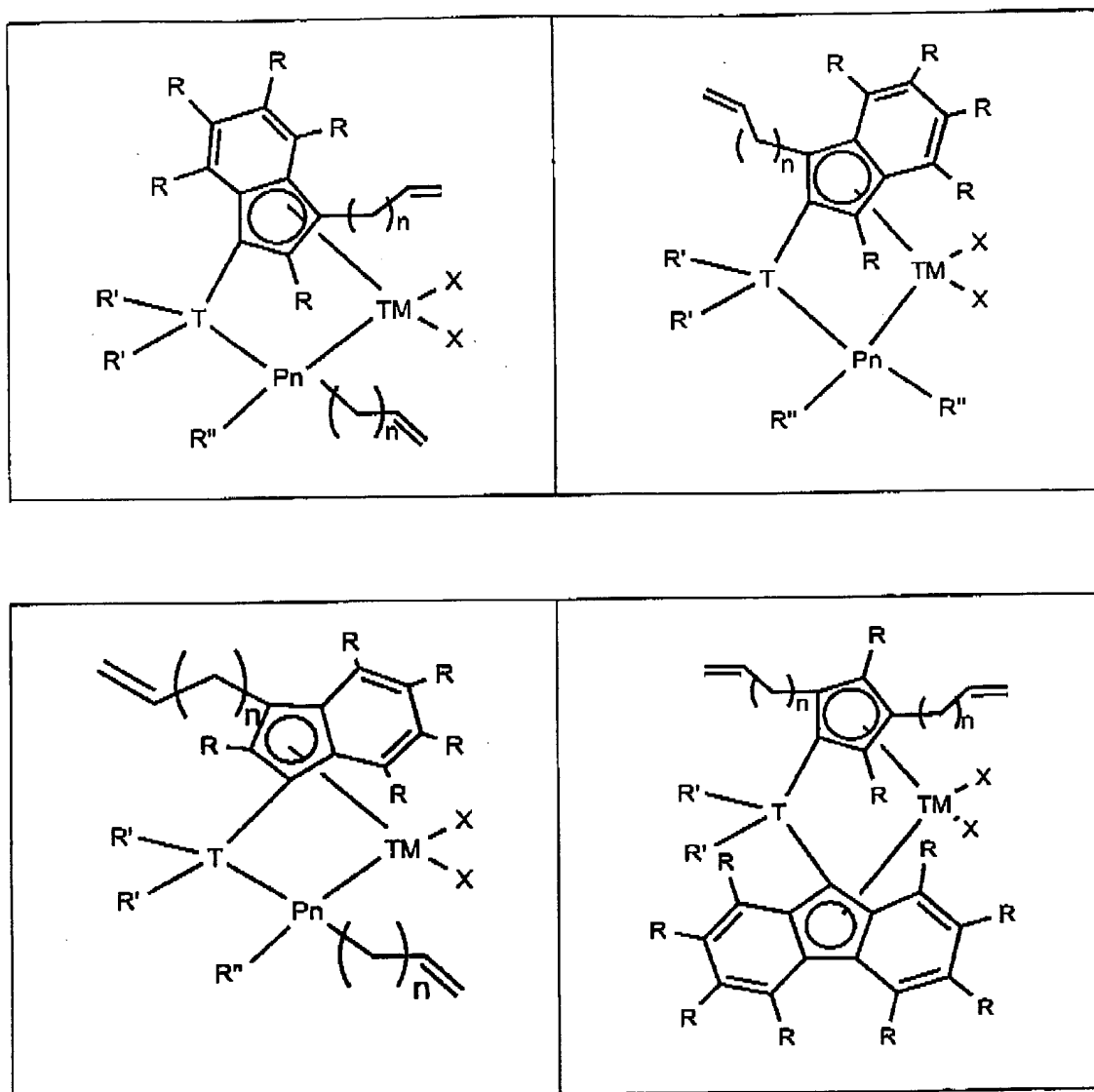
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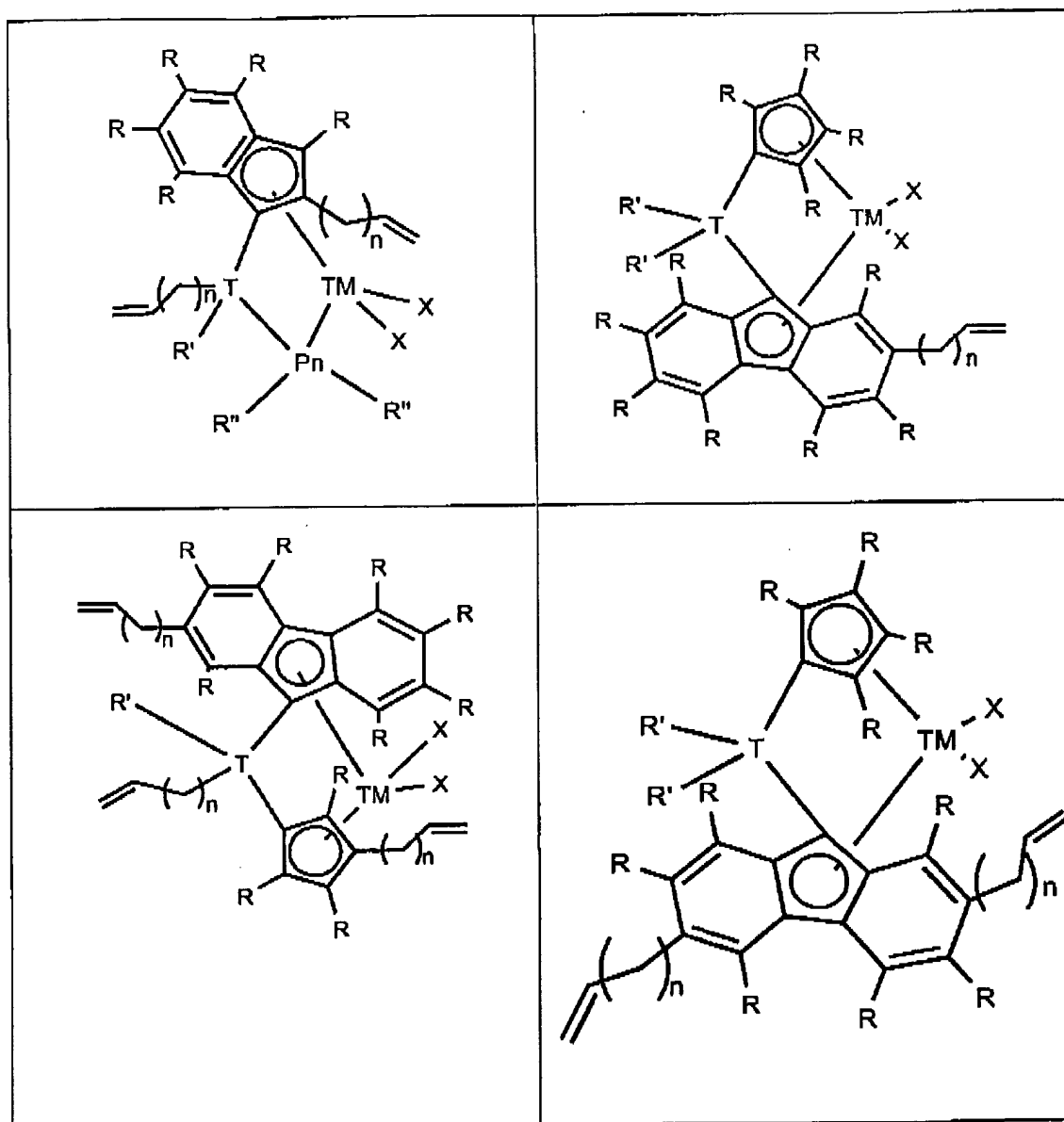
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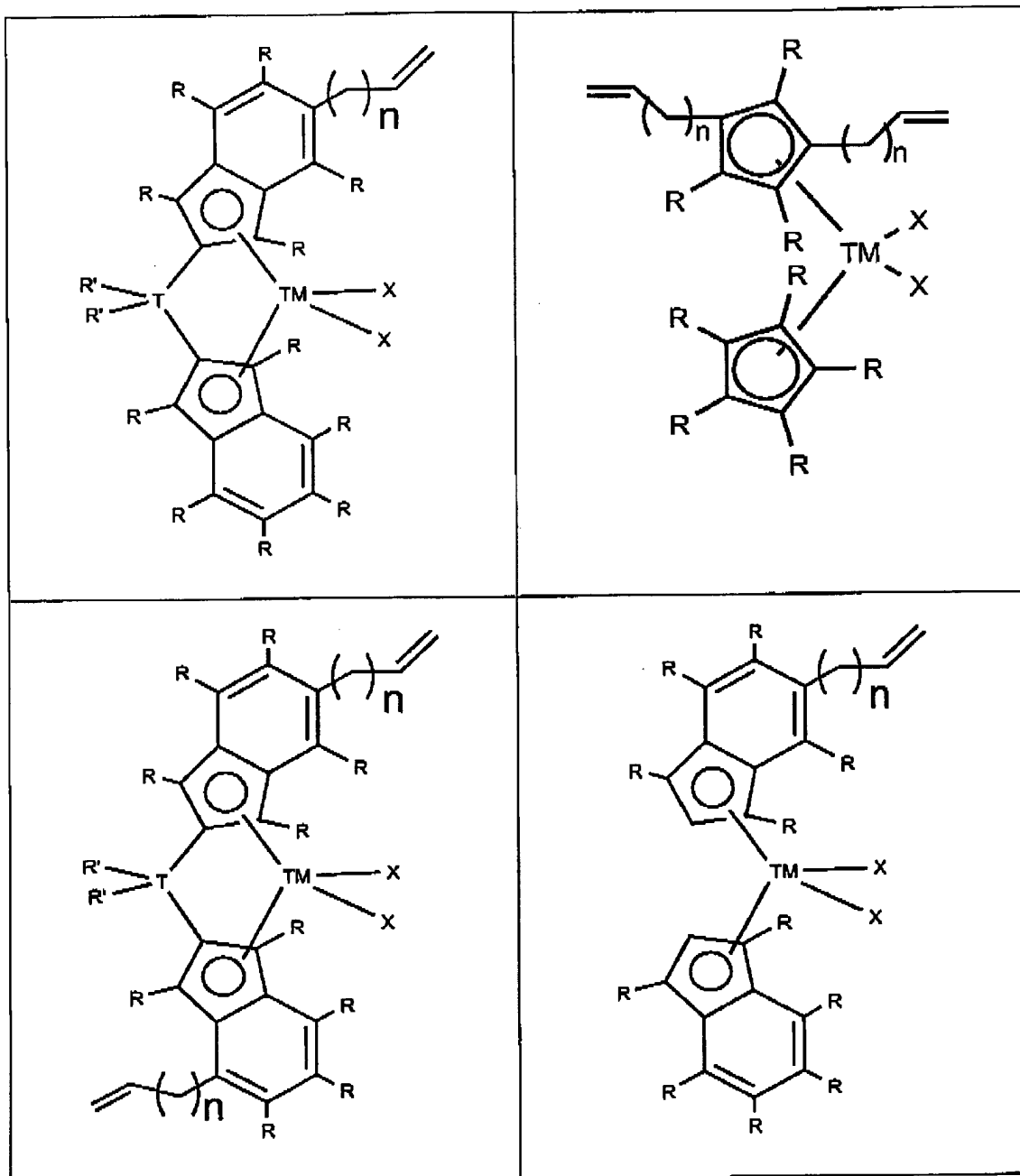
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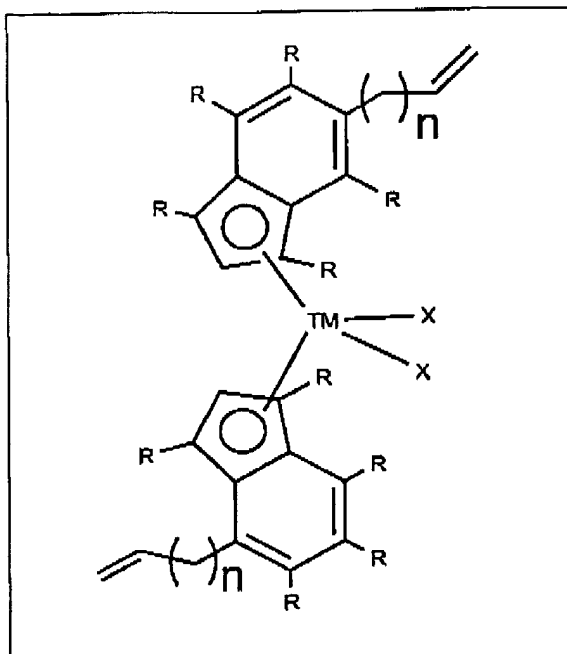
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wherein

- (a) X are the same or different abstractable ligand D or E;
- (b) Each R, R', and R'' are independently selected from hydrogen or a hydrocarbonyl group provided at least one of R, R', and R'' can be polymerized by a free radical initiator;
- (c) TM is a titanium Group 4-11 metal;
- (d) n is an integer from 0-3; and
- (e) Pn is a Group-14-15 atom.

21. (withdrawn) An olefin polymerization method comprising the steps of combining an olefin with the composition of Claim 1, and an activator.

22. (withdrawn) An olefin polymerization method comprising combining the compositional Claim 3 with an olefin and an activator, where

(a) the olefin monomer, and the catalyst and the activator are combined under polymerization conditions comprising:

(i) slurry polymerization conditions wherein slurry polymerization conditions comprise:

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- a reaction temperature of 0-120 °C;
- a reaction pressure of 103-5068 kPa gauge;
- a reaction media selected from C₃-C₇ alkanes; and
- a primary monomer concentration of 1-10 wt% based on the total weight of monomer plus media;

(ii) gas-phase polymerization conditions wherein gas-phase polymerization conditions comprise:

- a reaction temperature of 30-120 °C;
- a reaction pressure of 69 kPa-3.5 MPa gauge; and
- a primary monomer partial pressure of 138 kPa-2.1 MPa;

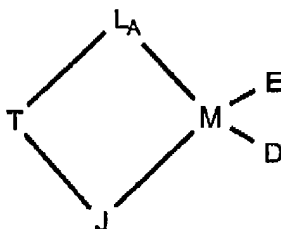
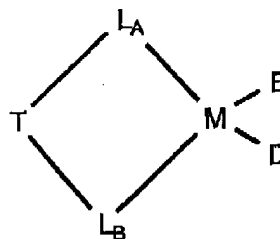
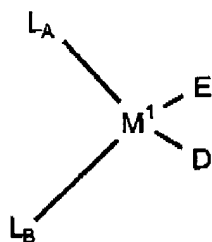
or

(iii) solution polymerization conditions wherein solution polymerization conditions comprise:

- a reaction temperature of 0-120 °C;
- a reaction pressure of 103-5068 kPa; and
- a solvent selected from toluene, benzene, xylene, or hexane.

23. (new) A composition comprising a bifunctional metallocene catalyst comprising the product of combining, in the presence of a free radical initiator, two or more catalyst precursors and at least one monomer wherein the monomer is polymerizable by free-radical polymerization, and wherein the catalyst precursors are represented by at least one of the formulas:

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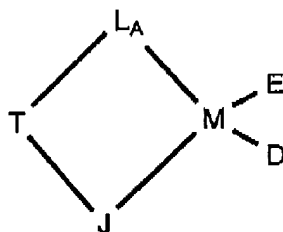


wherein

- (a) each M is a Group 3-10 metal;
each M' is Group 3-10 metal;
- (b) L_A is a substituted or unsubstituted, cyclopentadienyl or heterocyclopentadienyl ligand connected to M wherein L_A comprises R;
- (c) L_B is
 - (i) a ligand as defined for L_A but selected independently of L_A, or
 - (ii) J, a heteroatom ligand connected to M, wherein J comprises a Group-14-15 atom and 0-2 of R'';
- (d) T is a bridging group that connects L_A and L_B and comprises a Group-13-to-16 element and 0-2 of R'; and
- (e) D and E are the same or different abstractable ligands,
wherein each R, R', and R'' are independently hydrogen or a hydrocarbyl group provided at least one of R, R', and R'' can be polymerized by a free radical initiator, provided that when M' is Zr, L_A is substituted at more than one carbon atom, and wherein the two or more catalyst precursors each have a different Group 4 metal.

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24. (new) A composition comprising the product of combining, in the presence of a free radical initiator, a catalyst precursor and at least one monomer wherein the monomer is polymerizable by free-radical polymerization, and wherein the catalyst precursor is represented by one of the formulas:



wherein

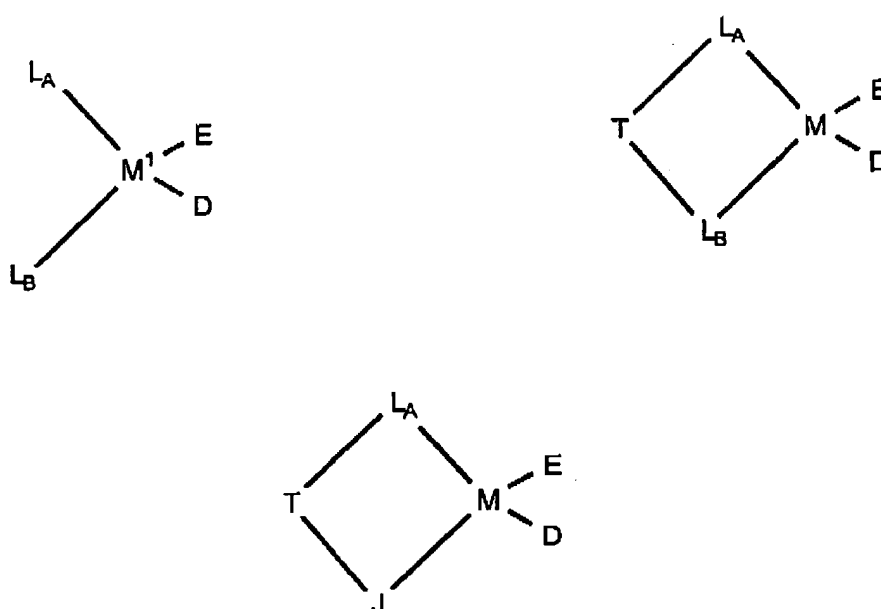
- (a) M is a Group 3-10 metal;
- (b) L_A is a substituted or unsubstituted, cyclopentadienyl or heterocyclopentadienyl ligand connected to M, wherein L_A comprises R;
- (c) J is a heteroatom ligand connected to M, wherein J comprises a Group-14-15 atom and 0-2 of R'';
- (d) T is a bridging group that connects L_A and L_B and comprises a Group-13-to-16 element and 0-2 of R'; and
- (e) D and E are the same or different abstractable ligands,

wherein each R, R', and R'' are independently hydrogen or a hydrocarbyl group provided at least one of R, R', and R'' can be polymerized by a free radical initiator.

- 25. (new) The composition of Claim 24 wherein the at least one monomer comprises styrene, vinyl styrene, alkyl styrene, isobutylene, isoprene, or butadiene.
- 26. (new) The composition of Claim 24 wherein the one or more monomers comprise styrene.
- 27. (new) The composition of Claim 24 wherein the free radical initiator is selected from the group consisting of azo initiators or peroxides.

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28. (new) The composition of Claim 24, wherein M is a Group 4 metal.
29. (new) The composition of Claim 24, wherein M is titanium.
30. (new) A composition comprising the product of combining, in the presence of a free radical initiator, a catalyst precursor and at least one monomer wherein the monomer is polymerizable by free-radical polymerization, and wherein the catalyst precursor is represented by one of the formulas:



wherein

- (a) M is a Group 3, or Group 5–10 metal;
 M' is a Group 3, or Group 5–10 metal;
- (b) L_A is a substituted or unsubstituted, cyclopentadienyl or heterocyclopentadienyl ligand connected to M wherein L_A comprises R;
- (c) L_B is
- (iii) a ligand as defined for L_A but selected independently of L_A , or
 - (iv) J, a heteroatom ligand connected to M, wherein J comprises a Group-14-15 atom and 0-2 of R";

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(d) T is a bridging group that connects L_A and L_B and comprises a Group-13-to-16 element and 0-2 of R' ; and

(e) D and E are the same or different abstractable ligands,

wherein each R, R' , and R'' are independently hydrogen or a hydrocarbyl group provided at least one of R, R' , and R'' can be polymerized by a free radical initiator.

31. (new) The composition of Claim 30, wherein the at least one monomer comprises styrene, vinyl styrene, alkyl styrene, isobutylene, isoprene, or butadiene.

32. (new) The composition of Claim 30, wherein the one or more monomers comprise styrene.

33. (new) The composition of Claim 30, wherein the free radical initiator is selected from the group consisting of azo initiators or peroxides.